GREENHOUSE GAS / GLOBAL WARMING RISK ASSESSMENT
EDGEMOOR FACILITY DEMOLITION PROJECT
SANTEE, CA

Submitted to:

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INTRODUCTION AND DEFINITIONS

Existing Site Characterization

The project site covers approximately 21 acres and is located in San Diego County within the City of Santee as can be seen in Figure 1 on the following page. The County-owned site is approximately five miles northeast of Lake Murray, south of the San Diego River, and northwest of the corner of the intersection of N. Magnolia Avenue and Park Avenue within the City of Santee's Town Center Specific Plan area.

Regional access is provided to the site by State Route 67 (SR-67), a north/south freeway that runs between Interstate 8 (I-8) and the community of Ramona, and SR-125, a north/south freeway that runs between I-8 and SR-52. Local access is provided along N. Magnolia Avenue as can be seen in Figure 2 on Page 3 of this report. The project site is north of Mission Gorge Road, and is bounded to the west by Cottonwood Avenue, to the north by Chubb Lane, to the east by N. Magnolia Avenue, and to the south by Park Avenue.

Project Description

The Edgemoor Facility Demolition project proposes the demolition and removal of 26 buildings within the City of Santee. The proposed limits of demolition are shown in Figure 3 on Page 4 of this report and are anticipated to last a maximum of 180 days. The 26 buildings are currently associated with the Edgemoor Geriatric Hospital, which is owned and operated by the County of San Diego. Since their construction (ranging from 1913 to 1961), most of the buildings have been in continual use. Seven of the buildings have been vacant since the early 1980s. Two of the buildings are used by the Santee Food Bank and the Salvation Army on an interim basis unrelated to the hospital operation. Building 10, the Polo Barn, will be retained on site and will not be demolished.

In 2004, the San Diego County Board of Supervisors concluded that the buildings comprising the Edgemoor Geriatric Hospital were obsolete and deteriorating and that it would be more cost effective to build a new hospital than to rehabilitate the old buildings. In addition, the Board of Supervisors adopted Policy F-38 that establishes future development policy of the project site with a goal of maximizing revenue generation to support the new Edgemoor Skilled Nursing Facility.

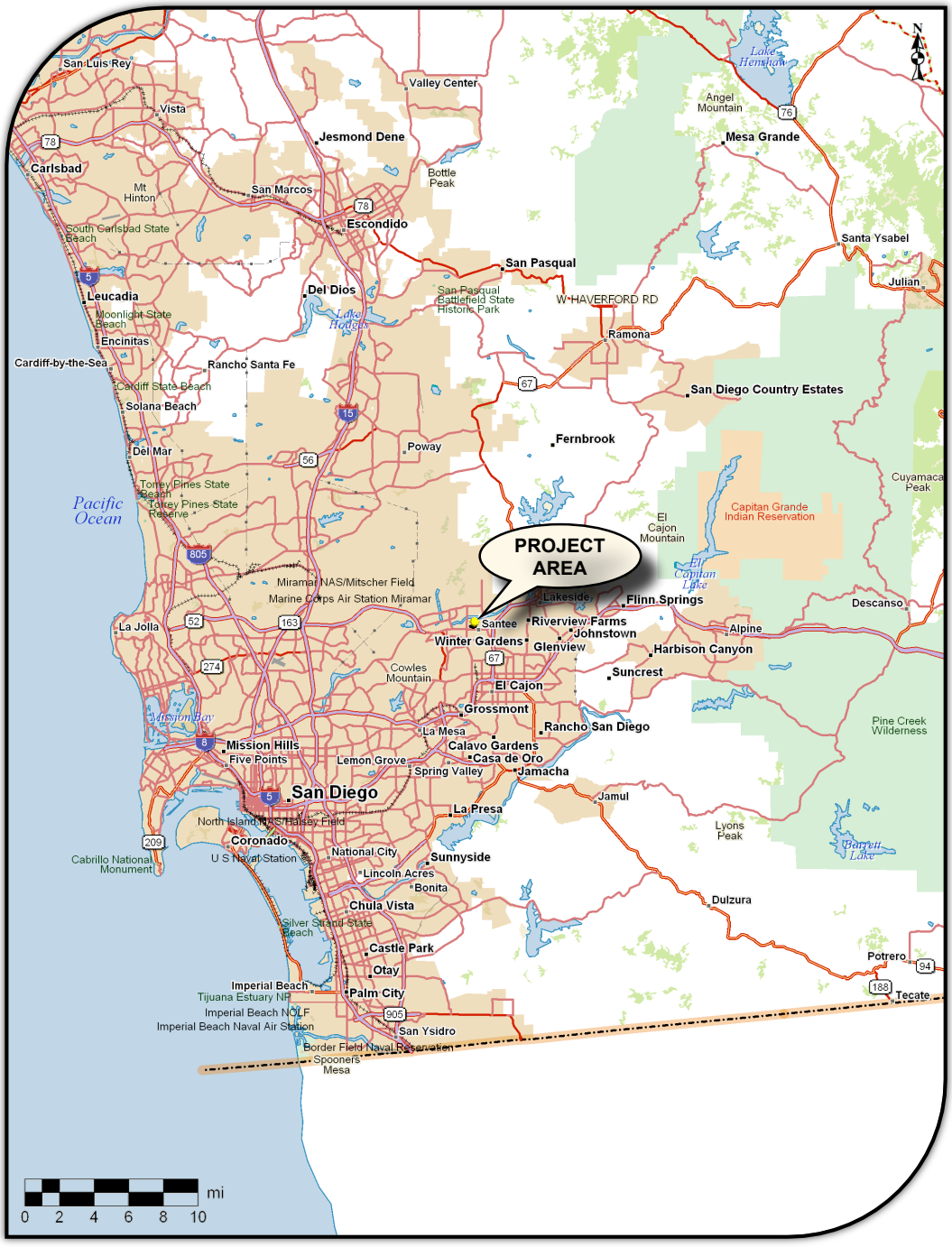

FIGURE 1: Project Vicinity Map w/ Topography (ISE 7/08)

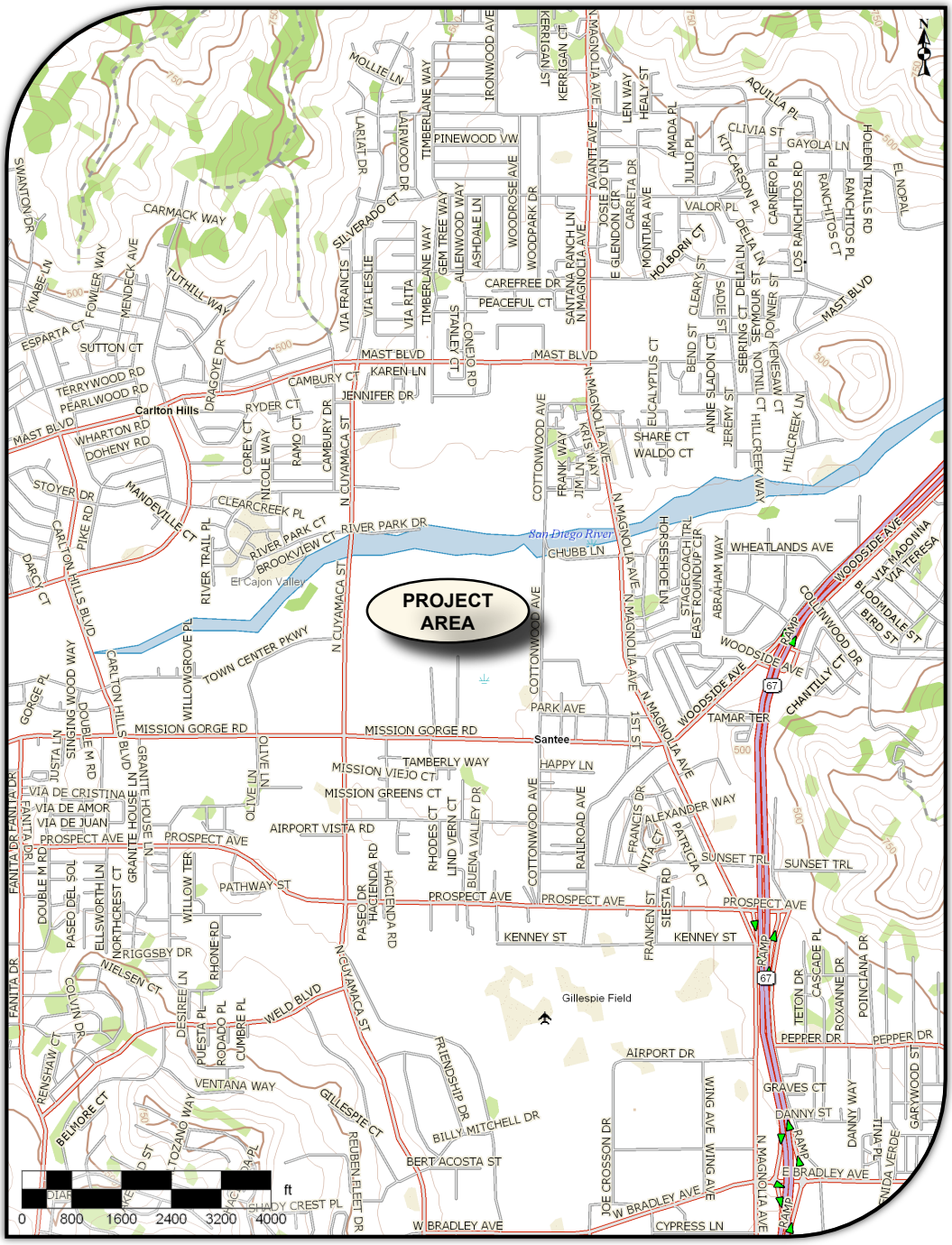

FIGURE 2: Project Site Location Map (ISE 7/08)

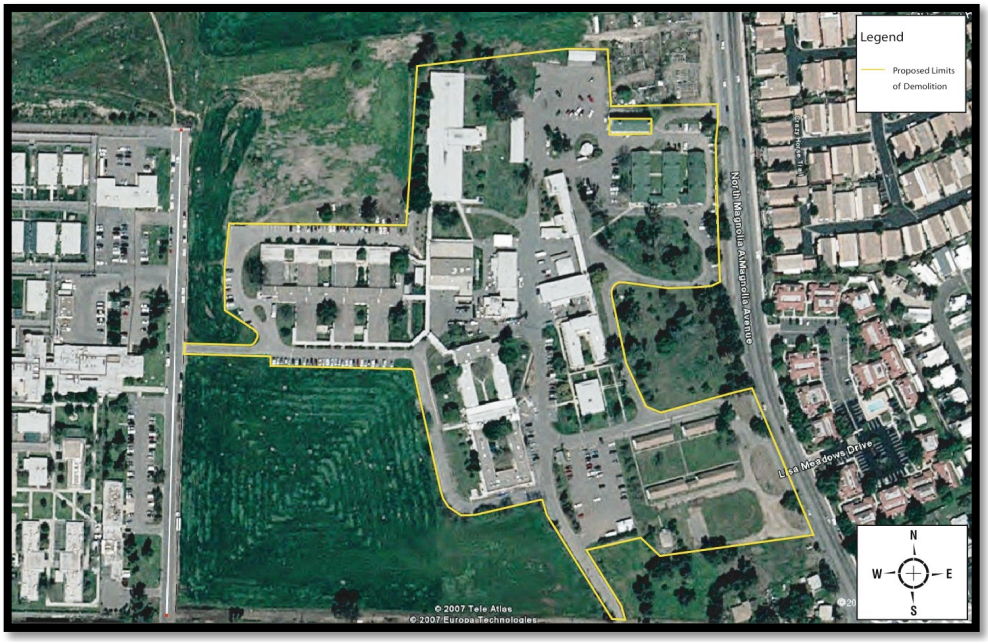

FIGURE 3: Proposed Limits of Edgemoor Site Demolition (HDR 7/07)

Historical Context of Global Warming

Much recent conjecture has been postulated as to the effect of the *so-called, 'Global Warming Phenomenon'* or *'Greenhouse Effect'* and its correlation to anthropogenic *'Greenhouse Gas (GHG) Emissions'*. The debate began based upon initial observations that global surface temperatures have been perceived to be steadily increasing over the past century (i.e., the period for which competent and reliable measurements have been taken).[1] Overall, the surface temperature reported by some, has seen an increase of roughly 0.6 degrees Centigrade, as can be seen in the first pane of Figure 4 on Page 5 of this report.[2,3]

[1] In fact, the notion that manmade global warming was a possibility has existed since the early 1880's and been the subject of debate both within the realms of science-fact as well as science fiction.

[2] This increase in temperature, which is formally expressed by the United Nations as *0.6 ± 0.2 degrees Centigrade*, produced the majority of its increase before 1940 AD, which is the generally accepted date when anthropogenic atmospheric CO_2 levels started any noticeable increase. The data presented in the first pane of Figure 4 provides information from surface temperature stations (red bars) as well as the annual average (the black trend line). The grey bars indicate the 95-percent confidence limits on the data. The black global temperature line (which is the basis of the whole global temperature increase argument) is only as good as the bounds of the grey tick-marks (which can have errors as large as, or larger than, the data point being represented).

[3] *Source:* IPCC, 2001, *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson(eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 388-389.

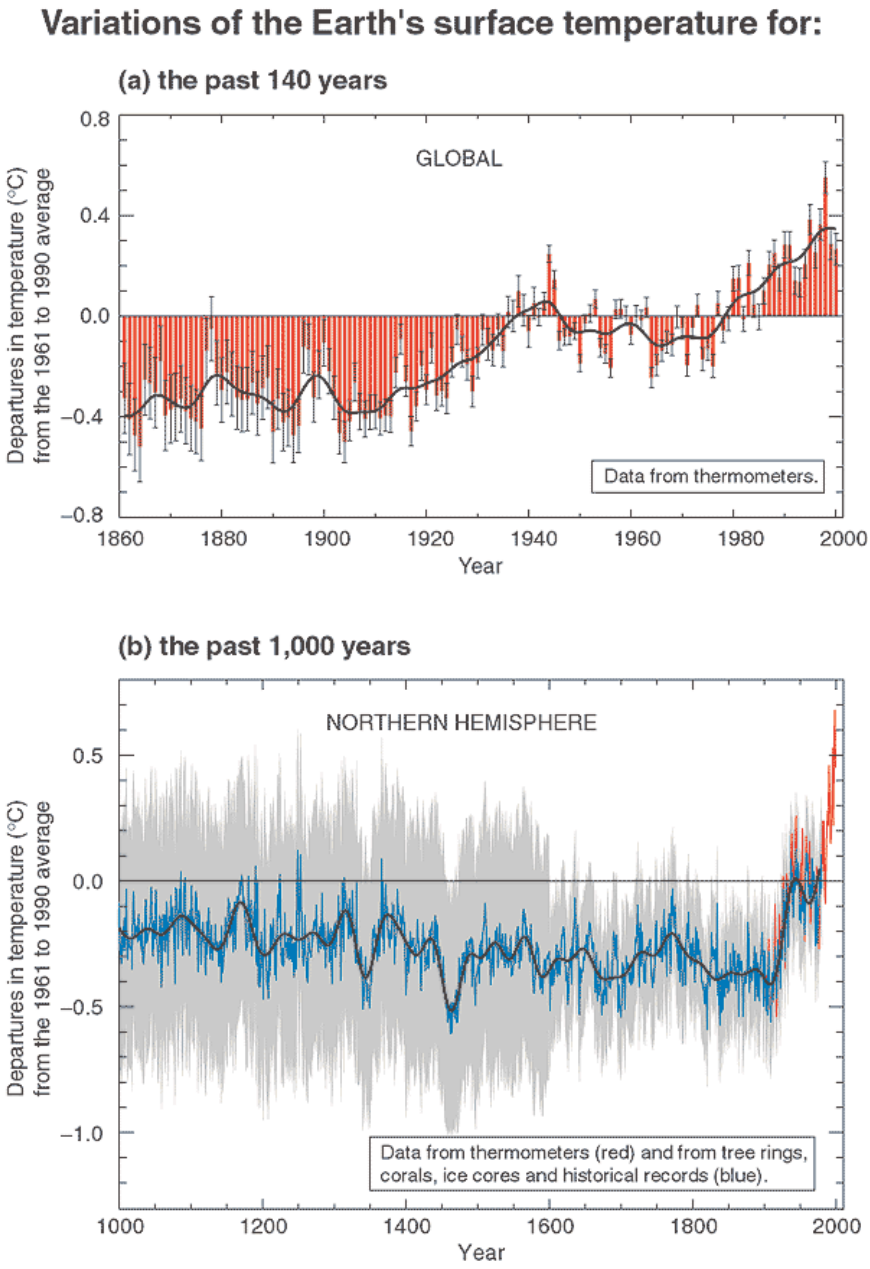

FIGURE 4: Measured/Predicted Temperature Global Temperature Variations (UN IPCC)[4]

[4] From the *Third Assessment Report of Working Group I* of the Intergovernmental Panel on Climate Change (IPCC), 2001.

Further examination of ice core records and tree ring data allowed researchers to probe far back in time to look at surface temperature variations over the past millennia (refer to the second pane of Figure 4). [5,6] The results would seem to indicate a noticeable increase in surface temperature over the past 100 years, occurring in roughly 1910 AD, becoming cyclically maximal around 1940 AD, and having a period of recurrence of slightly over 30 years.[7]

This observation led then Prime Minister Margaret Thatcher following the United Kingdom's (UK's) General Election of 1979 to adopt what was at the time believed to be a relatively arcane and obscure theory for her pro-nuclear power generation platform: namely, the notion that Carbon Dioxide (CO_2) was the primary constituent to atmospheric warming, and that fossil-fuel {coal} burning power plants should be replaced with cleaner sources.[8] At her insistence, the UK's *Hadley Centre for Climate Prediction and Research* was formed to advance this theory. This center ultimately became the operating agency for the IPCC's scientific Working Group I.

Greenhouse Gases and Global Warming Potential

Greenhouse gases are defined as those naturally occurring and anthropogenic chemical compounds within the atmosphere that absorb and reflect infrared radiation emitted by the Earth's surface.[9] A numerical metric known as the*, 'Global Warming Potential'* (GWP) is a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming relative to Carbon Dioxide (whose GWP defined as 1.0).

Naturally occurring greenhouse gases include the aforementioned carbon dioxide (CO_2), water vapor, methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). In addition, several classes of halogenated substances that contain fluorine, chlorine, or bromine also demonstrate a 'greenhouse' gas potential. Examples of these pollutants are

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[5] *Ibid.*

[6] The second pane of temperature trends from the IPCC report shows the same red bars (known temperature station data from the past 100 years), as well as a blue curve (which is a reconstructed temperature curve based upon ice cores and the like), and also a black curve, which is the 50-year moving average line. As in the previous graph pane, the grey marks indicate the 95-percent confidence intervals of the data. The IPCC report is very careful in its wording with respect to the historical reconstruction (which would indicate that over the past 1,000 years the temperature has been hotter, or colder, or neither – namely, it is statistically meaningless). Incidentally, this is the infamous *'hockey-stick'* graph highly touted by Al Gore as conclusive proof of anthropogenic global warming – a graph from which the UN has been very much distancing itself over the past couple of years.

[7] Recent (2007) Microwave Sounding Unit (MSU) temperature measurements made from NOAA's polar-orbiting satellite platforms of the lower troposphere indicate a *cooling* of the planet despite an incremental increase in CO_2 levels. In fact, the same satellites have shown a steady *decrease* in temperature within the tropopause of 0.314 degrees Centigrade per decade since 1979, so that now the original UN's increase of 0.6 ± 0.2 degrees Centigrade has all but disappeared.

[8] This, in historical context, is based upon what many believe was Mrs. Thatcher's desire to limit the *National Union of Mineworkers* (NUM) political power, due to her Conservative Party's defeat in 1974 primarily because of the NUM.

[9] The basic mechanism can be summarized as follows: 1) solar radiation heats the planet primarily through ultraviolet and higher energy transmission, 2) the rock {Earth} gets warm and is offset by temperature levels in the oceans (which act as a global thermostat), 3) the warm rock emits black-body radiation in the lower infrared portion of the electromagnetic spectrum, 4) most of the infrared radiation escapes the planet in accordance with the First Law of Thermodynamics, 5) a small portion of the energy is captured through molecular motion changes within the atmospheric greenhouse gases, and 6) this captured energy re-radiates back toward the rock (and space for that matter) producing a secondary heating effect. However, despite its name, this is not the same mechanism by which a greenhouse operates.

Halocarbons, perfluorocarbons (PFC's), and sulfur hexafluoride (SF_6), etc. A complete listing of known greenhouse gasses is shown in Table 1 on the following page.

Examples of the more prevalent gases are detailed below:

- Carbon dioxide (CO_2): CO_2 is naturally occurring gas and is part of the *carbon cycle* whereby carbon is cycled between the atmosphere, ocean, terrestrial life, and mineral reserves. The predominant source of anthropogenic carbon dioxide emissions is from the combustion of fossil fuels and hydrocarbons. Without CO_2, all life on Earth would cease to exist. Carbon Dioxide is the reference gas against which all other greenhouse gases are compared. It has a Global Warming Potential (GWP) of 1.0 and makes up approximately 3.6 percent of the global warming gases in the atmosphere today.

- Water Vapor (H_2O): Water is a chemical compound that is essential to all known forms of life and has been denoted as '*the universal solvent*'. Water vapor is the gaseous form of water comprising roughly 0.001% of all water on the planet. Without H_2O, all life on Earth would cease to exist. Although water vapor has the ability to capture roughly 10 times the infrared energy as CO_2, its GWP was omitted from the IPCC's report.[10] Water vapor makes up approximately 95 percent of the global warming gases in the atmosphere today.

- Methane (CH_4): CH_4 is greenhouse gas with both natural and anthropogenic sources and is believed to be the primary atmospheric constituent during the early primordial Earth. Methane is naturally produced by the anaerobic decomposition of organic matter. Methane is also emitted during the production and distribution of natural gas and petroleum and is released as a by-product of incomplete {low-temperature} fossil fuel combustion. It is estimated that a little more than half of the current methane emissions to the atmosphere are from anthropogenic sources. Methane has a GWP of 23 and constitutes approximately 0.36 percent of the global warming gases in the atmosphere today.

- Nitrous Oxide (N_2O): Primarily, N_2O is naturally produced by bacterial action within the soil and anthropogenically by high temperature combustion. The result is more-or-less the production of photochemical smog. Lesser sources such as manufacturing, wastewater treatment, and biomass burning also produce trace amounts of this substance. N_2O has a GWP of 296, and constitutes approximately 0.95 percent of the global warming gases in the atmosphere today.

- Halocarbons (CFC's) / Perfluorocarbons (PFC's) are carbon compounds that contain fluorine, chlorine, bromine or iodine. Anthropogenic sources are the primary (if not sole) generator of these substances. These gases have GWP's ranging from slightly over 100 to as high as 22,000. These gases constitute a mere 0.072 percent of the global warming gases in the atmosphere today.

[10] In fact, the IPCC scientific panel states that about half of the projected global temperature increase from CO_2 is due to what is referred to as the *water vapor feedback effect*. In order to quantify the level of feedback due to water vapor, one needs to know the radiative efficiency of H_2O in vaporous form (i.e., the GWP). For some reason, nowhere in the IPCC report is this critical value presented.

TABLE 1: Known Greenhouse Gases and Global Warming Potential[11]

Pollutant Name	Chemical Formula	GWP Relative to CO_2 (100 year horizon)
Carbon Dioxide	CO_2	1
Dibromomethane	CH_2Br_2	1
R-13I1 (Trifluoroiodomethane)	FIC-13I_1	1
R-E170 (Dimethyl ether)	CH_3OCH_3	1
Methyl Bromide	CH_3Br	5
Dichloromethane	CH_2Cl_2	10
R-161 (HFC-161, Fluoroethane)	HFC-161	12
R-40 (Methyl Chloride)	CH_3Cl	16
Methane	CH_4	23
Chloroform	$CHCl_3$	30
2,2,3,3,3-Pentafluoro-1-propanol	$CF_3CF_2CH_2OH$	40
R-152 (HFC-152, 1,1-Difluoroethane)	HFC-152	43
2,2,2-Trifluoro-ethanol	$(CF_3)CH_2OH$	57
R-41 (HFC-41, Methyl fluoride)	HFC-41	97
R-123 (HCFC-123, Dichlorotrifluoroethane)	HCFC-123	120
R-152a (HFC-152a, 1,1-Difluoroethane)	HFC-152a	120
1,1,1-Trichloroethane	CH_3CCl_3	140
1,1,1,3,3,3-Hexafluoro-2-Propanol	$(CF_3)_2CHOH$	190
R-21 (Dichlorofluoromethane)	HCFC-21	210
Nitrous Oxide	N_2O	296
HFC-143, 1,1,2-Trifluoroethane	HFC-143	330
Methyl perfluoroisopropyl ether	$(CF_3)_2CFOCH_3$	330
Bromodifluoromethane	$CHBrF_2$	470
R-32 (HFC-32, Difluoromethane)	HFC-32	550
R-124 (HCFC-124, 2-Chloro-1,1,1,2-Tetrafluoroethane)	HCFC-124	620
R-141b (HCFC-141b, 1,1-Dichloro-1-fluoroethane)	HCFC-141b	700
HFE-143a	HFE-143a	750
HFC-134, 1,1,2,2-Tetrafluoroethane	HFC-134	1100
R-12B1 (Difluorochlorobromomethane, Halo 1211)	Halon-1211	1300
R-134a (HFC-134a, 1,1,1,2-Tetrafluoroethane)	HFC-134a	1300
R-22 (Chlorodifluoromethane)	HCFC-22	1700
Carbon Tetrachloride	CCl_4	1800
R-142b (HCFC-142b, 1-Chloro-1,1-difluoroethane)	HCFC-142b	2400
R-125 (HFC-125, Fc-125, Pentafluoroethane)	HFC-125	3400
R-143a (HFC-143a, 1,1,1-Trifluoroethane)	HFC-143a	4300

[11] Source: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, IPCC 2001.

TABLE 1 (cont.): Known Greenhouse Gases and Global Warming Potential[12]

Pollutant Name	Chemical Formula	GWP Relative to CO_2 (100 year horizon)
R-11 (Trichlorofluoromethane)	CFC-11	4600
R-14 (Carbon Tetrafluoride)	CF_4	5700
R-113 (1,1,2-Trichloro-1,2,2-Trifluoroethane)	CFC-113	6000
R-E134 (HFE-134, 1,1,1',1'-Tetrafluorodimethyl ether)	HFE-134	6100
R-13B1 (Trifluorobromomethane, Halo 1301)	$CBrF_3$	6900
R-115 (Chloropentafluoroethane)	CFC-115	7200
C_3F_8 (Perfluoropropane)	C_3F_8	8600
C_4F_{10} (Perfluoro-n-Butane)	C_4F_{10}	8600
C_5F_{12} (Perfluoropentane)	C_5F_{12}	8900
C_6F_{14} (Perfluorohexane)	C_6F_{14}	9000
R-114 (Freon 114, 1,2-Dichlorotetrafluoroethane)	CFC-114	9800
R-C318 (Freon 318, Octafluorocyclobutane)	C-C_4F_8	10000
R-12 (Freon 12, Dichlorodifluoromethane)	CFC-12	10600
Nitrogen Trifluoride; Trifluoramine	NF_3	10800
R-116 (Perfluoroethane; Hexafluoroethane)	C_2F_6	11900
R-23 (HFC-23, Trifluoromethane)	HFC-23	12000
R-13 (Chlorotrifluoromethane)	CFC-13	14000
R-E125 (HFE-125, Pentafluorodimethyl ether)	HFE-125	14900
Sulfur Hexafluoride	SF_6	22200

THRESHOLDS OF SIGNIFICANCE

California Environmental Quality Act (CEQA) Thresholds

Section 15382 of the California Environmental Quality Act (CEQA) guidelines defines a significant impact as,

> *"… a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."*

Although Global Warming and the associated greenhouse gas effects are not explicitly defined under CEQA and yet to have any defined set of significance standards, the Section above is sufficiently broad enough in definition to allow its discussion within the air quality topic of CEQA.

[12] Source: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, IPCC 2001.

The California Global Warming Solutions Act (AB 32)

Operating under the assumption that Global Warming is a real phenomenon and that atmospheric carbon is the single largest contributor to the phenomenon, the California State Legislature passed the *California Global Warming Solutions Act of 2006* (Assembly Bill 32, or AB 32) which requires the California Air Resources Board (CARB) to develop regulations and market mechanisms that will ultimately reduce California's greenhouse gas emissions by 25 percent by 2020. Mandatory caps will begin in 2012 for significant sources and ratchet down to meet the 2020 goals. Specifically, AB 32 requires CARB to:

1) Establish a statewide greenhouse gas emissions cap for 2020, based on 1990 emissions by January 1, 2008.
2) Adopt mandatory reporting rules for significant sources of greenhouse gases by January 1, 2009.
3) Adopt a plan by January 1, 2009 indicating how emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms and other actions.
4) Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas, including provisions for using both market mechanisms and alternative compliance mechanisms.
5) Convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee to advise CARB.
6) Ensure public notice and opportunity for comment for all CARB actions.
7) Prior to imposing any mandates or authorizing market mechanisms, CARB must evaluate several factors, including but not limited to, impacts on California's economy, the environment and public health; equity between regulated entities; electricity reliability; conformance with other environmental laws; and that the rules do not disproportionately impact low-income communities.

For the purposes of analysis within this report and applicability to the proposed project as a whole, it will be sought to obtain a 25-percent net reduction goal of CO_2 emissions from the project to remain consistent with the intent of AB 32.

ANALYSIS METHODOLOGY

Greenhouse Gas Compilation Approach

Diesel Powered (Compression Ignition) Equipment Contribution

Greenhouse gas emissions associated with diesel engine combustion from onsite demolition equipment will be assumed to occur for engines running at the correct fuel to air ratios.[13] Of principal interest are the emission factors for CO_2 and NO_X[14]. For a

[13] The ratio whereby complete combustion of the diesel fuel occurs.

[14] It will be assumed that the project would generate trace-, if not negligible-, levels of methane (CH_4), ozone (O_3), fluorine (F_2), chlorine (Cl_2), bromine (Br_2) and/or constituent compounds. NO_x emissions are stoichiometrically composed of roughly 30-percent nitrous oxide (N_2O) by volume and 70-percent nitric oxide (NO), which is the free radical form that immediately combines with ozone (O_3) to form nitrogen dioxide (NO_2) more commonly known as *smog*.

four-stroke diesel-cycle engine, the combustion byproducts are approximately 1.5-percent-by-volume O_2, 0.5-percent-by-volume CO, and 13.5-percent-by-volume CO_2.[15] Thus, the ratio of CO_2 to CO production in a properly mixed diesel stroke would be 13.5/0.5 or 27:1.

Operational Motor Vehicle (Spark Ignition) Contribution

Greenhouse gas emissions associated with motor vehicle trips for the proposed demolition project were calculated by multiplying the appropriate emission factor (in grams per mile) times the estimated trip length and the total number of vehicles (which for this project would consist of the requisite number of trips required to haul the demolition debris to the closest landfill and the associated worker trips to and from the site each day). Appropriate conversion factors were then applied to provide aggregate emission units of pounds per day.

CARB estimates on-road motor vehicle emissions by using a series of models called the *Motor Vehicle Emission Inventory* (MVEI) Models. For the current analysis, the *EMFAC 2007 Model v2.3* of the MVEI[16] was run using input conditions specific to the San Diego air basin to predict vehicle emissions based upon the estimated year 2009 project completion date (i.e., the date whereby full completion of the demolition and debris removal is anticipated).

The aggregate greenhouse emission factors from the CARB *EMFAC 2007* model are provided as an attachment at the end of this report. Of principal interest are the emission factors for CO_2 and NO_X[17]. A mix ratio consisting of 80-percent haul trucks and 20-percent worker vehicles was assumed for the purposes of analysis.

Projected Greenhouse Gas Emissions Budget and Warming Effects Analysis

Since the IPCC's *cause-and-effect* relationship between anthropogenic greenhouse gases and global warming is dubious[18], the analysis presented herein will be to determine the net perceived greenhouse gas emissions from the proposed project development and examine the project's conformance under AB 32.

Further, to address the global warming aspect of the project implementation per AB 32, the proposed development will be modeled as a thermodynamically closed

[15] Source: Holtz, J.C., Elliott, M.A., *The Significance of Diesel-Exhaust-Gas Analysis, Transactions of the ASME, Vol. 63, February 1941*.

[16] This is the most current CARB emissions model approved for use within the State of California.

[17] It will be assumed that the project would generate trace-, if not negligible-, levels of methane (CH_4), ozone (O_3), fluorine (F_2), chlorine (Cl_2), bromine (Br_2) and/or constituent compounds. NO_x emissions are stoichiometrically composed of roughly 30-percent nitrous oxide (N_2O) by volume and 70-percent nitric oxide (NO), which is the free radical form that immediately combines with ozone (O_3) to form nitrogen dioxide (NO_2) more commonly known as *smog*.

[18] We say this, as scientists, with the utmost candor, since many of the findings within the IPCC reports are based upon elaborate computer modeling using selective input assumptions and apparently ignoring pertinent fundamentals of climate theory. Moreover, many of the predictions by the IPCC have never been empirically validated. In fact, the UN's concept of a simple linear relationship between atmospheric carbon dioxide and global mean temperature has never been proven since the global mean temperature has both risen and fallen during periods where atmospheric carbon dioxide has been steadily increasing.

system, subject only to increasing CO_2 concentrations (i.e., a type of *Urban Heat Island*[19] dependant only on CO_2*)* to determine the net change in radiative forcing, and ultimately temperature. The analysis presented herein is consistent and in accordance with the *First Law of Thermodynamics*[20].

FINDINGS

Greenhouse Gas Emission Tabulation

Diesel Powered (Compression Ignition) Equipment Contribution

The Edgemoor Facility Demolition Project would utilize a worst-case contingency of equipment consisting of two (2) CAT D8 bulldozers, two (2) loaders, and a water truck for dust control.[21] The pertinent equipment and their associated emissions are shown below in Table 2.

TABLE 2: Construction Vehicle GHG Emission Levels – Edgemoor Facility Demolition project

			Emission Rates per Day (in pounds)			
Equipment Classification	**Quantity**	**Hours/Day**	**CO**	**NO_X**	**$CO_2 = 27 \cdot CO$**	**$N_2O = 0.3 \cdot NO_X$**
Dozer - D8 Cat	2	6	21.6	55.2	583.2	16.6
Loader	2	6	12.2	17.8	329.4	5.3
Water Truck	1	6	3.6	12.6	97.2	3.8
		SUM (Σ):	**37.4**	**85.6**	**1009.8**	**25.7**

Since N_2O has a GWP of 296 with respect to CO_2, this result can be expressed as an *equivalent* CO_2 level (sometimes denoted as CO_{2e}) of 7,607.2 pounds. Thus the final equivalent CO_2 GHG load due to the project would be the summation of this value and the direct CO_2 production shown in Table 2 above, or 8,617.0 pounds CO_{2e} per day while demolition activities commence.

Since demolition would occur for a period of 180 days, the net CO_{2e} level due to onsite activities at the Edgemoor site would be 1,551,060 pounds.

[19] An Urban Heat Island (or UHI) is a developed area that is significantly warmer than its undeveloped surroundings. The temperature difference usually is larger at night than during the day, and larger in winter than in summer, due to the re-radiation of solar energy by paved surfaces and buildings, and waste heat generated by energy usage and building heating and cooling. Water vapor will be completely ignored from the analysis (as is done in the United Nations source document), although the reader is cautioned that this approach, as with the IPCC approach, provides a false indication of the warming effects of the remaining greenhouse gases.

[20] Simply expressed, the *First Law of Thermodynamics* states that for any thermodynamic system, the sum of the heat 'h' contained within the system (or that it receives) plus the work 'w' that the system is capable of (or receives) is equal to the total internal energy 'E' of the system. The first law of thermodynamics basically states that a thermodynamic system can store energy in two different forms (namely heat and/or work) and that this internal energy is conserved.

[21] Based upon anticipated worst-case equipment requirements to demolish a facility of the size shown in Figure 3 within a 180-day period.

Operational Motor Vehicle (Spark Ignition) Contribution

Motor vehicles are a secondary source of greenhouse gas emissions associated with the proposed project. The proposed project site is expected to have a total trip generation level of approximately 1,900 trips based upon the cumulative minimum trip generation required for demolition haul truck usage (identified as a minimum of 1,504 trips based upon estimated tonnage) and worker vehicle trips.[22] The trip length would be 15 miles based upon the logistics of worker commute distance and dump site round-trips.[23]

The vehicular emission rates of concern are attached at the end of this report. The aggregate project emission levels are shown in Table 3 below. A median running speed of 45 MPH was used consistent with average values observed (i.e., combined freeway and surface street traffic activity).

TABLE 3: Operational Vehicle GHG Levels – Edgemoor Facility Demolition Project

Vehicle Classification	Total Trips	Total Emissions for Project (in pounds)	
		CO_2	N_2O
Light Duty Autos (LDA)	380	3622.7	1.3
Heavy Duty Trucks (HDT)	1,520	70,041.2	173.3
Total:	**1,900**	**73,663.9**	**174.5**

Again, since N_2O has a GWP of 296 with respect to CO_2, the *equivalent* CO_{2e} level would be 51,652.0 pounds for N_2O. The final equivalent CO_{2e} load due to all vehicular traffic would be 125,315.9 pounds.

Projected Project Greenhouse Gas Emissions Budget

The projected greenhouse gas emission budget for the proposed project would be the summation of the individual sources identified under the previous section. Thus, the total budget would equate to the following levels shown in Table 4 on the following page.

[22] The estimate of 1,900 total vehicle trips is made to provide a representative trip generation level for the project with a requisite margin of safety. Hence, assuming a 20-percent passenger car level (for worker commute) and an 80-percent heavy duty truck level for debris haulage gives a total of 380 passenger car trips and 1520 maximum debris removal trips over the assumed 180-day demolition period.

[23] This is again based upon logistical considerations given a local work force and a single-trip distance to the Santee Landfill of approximately 5.0 miles.

TABLE 4: GHG Emission Budget for Edgemoor Facility Demolition Project

Project Scenario	CO_{2e}	Total Project Emissions Pounds per ...
Construction Operations	1,551,060.0	Total construction period
Operational Vehicle Emissions	125315.9	‘ ‘
Total Emissions	1,676,375.9	‘ ‘

The total aggregate GHG emissions would be 1,676,375.9 pounds CO_{2e} over the course of the 180-day demolition project.

This CO_{2e} level should be put into contrast against statewide daily vehicular CO_2 emissions, which have an estimated reference calendar year 2009 level of 551,310 tons per day.[24] Under this comparison, the net contribution of the proposed project to the overall daily vehicular-generated CO_{2e} level would be:

$$\mathrm{CO_{2e}\ Contribution_{Project,\%}} = \frac{1{,}676{,}375.9}{(551{,}310 \times 2{,}000)} = 0.00152 = 0.152\%$$

The proposed project action would generate an inconsequential increase compared to the net daily vehicular trip generation within California for the baseline year.[25] This would be deemed as non-impactive under the commonly accepted definition of this term within CEQA.

Projected Warming Effects Due to Project Equivalent CO_2

Carbon dioxide contributes approximately 32 watts per square-meter (W/m^2) of long-wave radiative forcing to the climate system under a clear-sky condition out of a total of 125 watts per square-meter for all atmospheric gasses under the same conditions.[26,27] The total radiative forcing from the Sun as of 1997 was 342 W/m^2.

The proposed Edgemoor Facility Demolition Project would contribute a total of 1,676,375.9 pounds of CO_{2e} over the 180-day demolition period. Assuming all CO_2 mixing occurs within the Troposphere[28], the thermodynamic system consisting of the project boundaries would have a volume of,

[24] Per the *EMFAC 2007* statewide tabulation for calendar year 2009, which is provided as an attachment to this report. Vehicular emissions are cited by the State of California as the largest CO_{2e} source.

[25] The baseline year was selected for informational purposes and comparison to a common point of reference. For future years, the CO_2 level is expected to increase yielding an even smaller percentage than that shown.

[26] The complete atmospheric gas ratios being: H_2O = 75 W/m^2, CO_2 = 32 W/m^2, O_3 = 10 W/m^2, and CH_4 + N_2O + overlap gasses = 8 W/m^2. The percentage contribution to a clear sky being: H_2O = 60%, CO_2 = 26%, O_3 = 8%, and CH_4 + N_2O + overlap gasses = 6%.

[27] Source: Kiel, J.T., and Trenberth, K.E., *Earth's Annual Global Mean Energy Budget*, National Center for Atmospheric Research, Boulder CO / Bulletin of the American Meteorological Society, 8/5/96.

[28] The troposphere is the lowest portion of Earth's atmosphere and contains approximately 75% of the atmospheric mass of the planet and almost all of its water vapor and Gag's. The average depth of the troposphere is approximately seven miles (≈37,000 feet).

$$V_{\text{system}} = 21 \text{ acres} \times \frac{43560 \text{ sq - ft}}{\text{acre}} \times 37{,}000 \text{ ft} = 3.3846x10^{10} \text{ft}^3$$

Since one part-per-million-by-volume (ppmv) equals 6.2428x10^{-5} pounds-per-cubic-foot, the increase in the system due to the totality of demolition activities would be,

$$CO_{\text{Conc}_{\text{System}}} = \frac{1{,}676{,}375.9 \text{ pounds}}{3.3846\text{x}10^{10} \text{ ft}^3} \times \frac{1 \text{ ppmv}}{6.2428\text{x}10^{-5} \frac{\text{pounds}}{\text{ft}^3}} = 0.7934 \text{ ppmv}$$

Thus, the total project-related concentration increase of CO_{2e} within a Tropospheric system bounded by the project extents would be 0.7934 ppmv.[29]

The change in radiative forcing due to a change in CO_{2e} is defined within the IPCC report[30] as,

$$\Delta F = \alpha \, Ln\left(\frac{C}{C_0}\right)$$

where, ΔF is the change in the radiative forcing (in W/m^2),
α is the atmospheric forcing coefficient = 5.35,
C is the baseline plus project CO_2 and CO_{2e} concentrations (in ppmv), and,
C_0 is the baseline CO_2 concentration (commonly taken as 380 ppmv).

Substituting above values gives an additional radiative forcing due to the proposed project of,

$$\Delta F = 5.35 \, Ln\left(\frac{380 + 0.7934}{380}\right) = 0.0112 \, \text{W}/\text{m}^2$$

Surface air temperature sensitivity factors cited by the IPCC have a global average of approximately 0.1 °C/W/m^2. Thus, the net increase in temperature due to the proposed project's CO_{2e} emissions would be,

$$\Delta T_{\text{Project}} = 0.1 \frac{^{\circ}\text{C}}{\text{W}/\text{m}^2} \times 0.0112 \text{W}/\text{m}^2 = 0.0011 \ ^{\circ}\text{C}$$

This level equates to a negligible increase in the closed system of 0.0011 °C (0.0019 °F) over a 180-day period. The closed system would experience a nominal one-

[29] It should be noted to the reader that this effectively equates to a closed system with a continuously increasing concentration of CO_2 (i.e., all positive feedback and all CO_2 confined within the boundaries of th project development). This is a highly unrealistic and highly worst case condition.

[30] Source: *Third Assessment Report of Working Group I* of the Intergovernmental Panel on Climate Change (IPCC), 2001.

degree Fahrenheit temperature increase after approximately 263.2 years under this condition.[31]

This result, expanded to a system encompassing the entire atmospheric mass of planet Earth[32], would further reduce the volumetric concentration, decrease the additional radiative forcing, and even assuming 100-percent positive feedback would produce no net impacts.[33] Therefore, no significant global warming temperature impact is expected due to the proposed project.

CONCLUSIONS / RECOMMENDATIONS

Project-Related Greenhouse Gas Budget / Global Warming Potential

The proposed Edgemoor Facility Demolition Project site was shown to produce an aggregate equivalent greenhouse gas load of 1,676,375.9 pounds of CO_{2e}. The local annual warming effect due to this level of project emissions was found to be 0.0019 °F, which would be deemed non impactive using the generally accepted definition of this term under CEQA. The net contribution on the planet as a whole would be deemed insignificant.

Compliance with AB 32 CO_2 Reduction Strategies

Consistent with the intent of AB 32, the proposed project would be required to demonstrate that it has policies in place that would provide a goal of 25-percent reduction in CO_2 by the year 2020. To this end, the following greenhouse gas offset measures have been shown to be effective by CARB and should be implemented wherever possible:

Diesel Equipment (Compression Ignition) Offset Strategies:

1) Use electricity from power poles rather than temporary diesel power generators.
2) Construction equipment operating onsite should be equipped with two to four degree engine timing retard or precombustion chamber engines.
3) Construction equipment used for the project should utilize EPA Tier 2 or better engine technology.

Vehicular Trip (Spark Ignition) Offset Strategies:

4) Encourage commute alternatives by informing employees and customers about transportation options for reaching your location (i.e. post transit schedules/routes).
5) Help employees rideshare by posting commuter ride sign-up sheets, employee home zip code

[31] Again, this is for the previously defined closed-system with ever increasing toxic levels of CO_2.

[32] Ninety-percent (90%) of the atmosphere of the planet Earth resides within 16 kilometers (16,000 meters) of the surface. Thus, the volume of the atmosphere is roughly $8.2x10^9$ km^3 ($8.2x10^{18}$ m^3 or $2.9x10^{20}$ ft^3). The mass of the atmosphere is roughly $5.3x10^{21}$ grams or $1.17x10^{19}$ pounds. Although mathematically finite, the net contribution of the proposed project to the planet as whole is physically zero.

[33] As can be seen by this illustrative example, even using the IPCC's approach, the cumulative contribution of land development projects has all but an infinitesimal effect in global temperature levels. In fact, these levels are so small that they are only mathematically predictable and not directly measurable using modern equipment.

map, etc.

6) When possible, arrange for a single vendor who makes deliveries for several items.
7) Purchase Carbon Offsets to compensate for miles traveled by company vehicles.
8) Plan delivery routes to eliminate unnecessary trips.
9) Keep vehicles well maintained to prevent leaks and minimize emissions, and encourage employees to do the same.
10) Provide car/van pool parking.
11) Provide secured and enclosed bicycle parking for employees (e.g., bike lockers).

CERTIFICATION OF ACCURACY AND QUALIFICATIONS

This report was prepared by Investigative Science and Engineering, Inc. (ISE) located at 1134 D Street, Ramona, CA 92065. The members of its professional staff contributing to the report are listed below:

Rick Tavares *(rtavares@ise.us)*	B.S. Aerospace Engineering / Engineering Mechanics M.S. Mechanical Engineering M.S. Structural Engineering Ph.D. Civil Engineering

ISE affirms to the best of its knowledge and belief that the statements and information contained herein are in all respects true and correct as of the date of this report. Should the reader have any questions regarding the findings and conclusions presented in this report, please do not hesitate to contact ISE at (858) 451-3505.

Content and information contained within this report is intended only for the subject project and is protected under 17 U.S.C. §§ 101 through 810. Original reports contain non-photo blue ISE watermark at the bottom of each page.

Approved as to Form and Content:

Rick Tavares, Ph.D.
Project Principal
Investigative Science and Engineering, Inc.

Attachments to this report: *EMFAC 2007* Emission Factors – Salton Sea Air Basin (2009)
EMFAC 2007 Emission Totals – Statewide Reference (2009)

EMFAC 2007 EMISSION FACTOR TABULATIONS – SCENARIO YEAR 2009

```
Title    : San Diego APCD Year 2009 - GHG Emissions
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/07/21 14:10:43
Scen Year: 2009 -- All model years in the range 1965 to 2009 selected
Season   : Winter
Area     : San Diego
*******************************************************************************
     Year: 2009 -- Model Years 1965 to 2009 Inclusive -- Winter
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

          San Diego                     Basin Average                 Basin Average

                          Table   1:  Running Exhaust Emissions (grams/mile)

     Pollutant Name: Oxides of Nitrogen        Temperature:  50F  Relative Humidity:  40%

     Speed
      MPH       LDA      LDT      MDT      HDT      UBUS     MCY      ALL

       10      0.501    0.776    1.337   18.944   24.972    1.302    1.438
       15      0.447    0.684    1.189   14.528   20.209    1.331    1.189
       20      0.408    0.616    1.086   12.669   17.194    1.367    1.060
       25      0.378    0.567    1.017   12.041   15.369    1.407    0.994
       30      0.358    0.532    0.975   11.618   14.424    1.451    0.950
       35      0.344    0.510    0.956   11.386   14.203    1.500    0.925
       40      0.337    0.499    0.957   11.340   14.669    1.551    0.918
       45      0.335    0.498    0.979   11.491   15.890    1.606    0.927
       50      0.339    0.506    1.025   11.860   18.058    1.665    0.955
       55      0.348    0.526    1.097   12.485   21.543    1.727    1.004
       60      0.364    0.558    1.204   13.432   26.998    1.793    1.081
       65      0.387    0.605    1.358   14.802   35.566    1.864    1.192


     Pollutant Name: Carbon Dioxide            Temperature:  50F  Relative Humidity:  40%

     Speed
      MPH       LDA      LDT      MDT      HDT      UBUS     MCY      ALL

       10   721.654  889.900 1245.001 2285.590 2506.690  200.863  902.519
       15   566.196  698.947  964.140 1934.567 2416.537  173.856  712.815
       20   461.073  569.821  779.057 1691.047 2361.643  153.547  584.919
       25   389.697  482.147  655.905 1592.053 2327.528  138.379  500.900
       30   341.840  423.364  574.626 1516.428 2306.274  127.292  444.380
       35   311.205  385.733  523.246 1459.579 2293.485  119.587  407.960
       40   294.024  364.629  494.783 1418.991 2286.753  114.836  387.250
       45   288.286  357.582  485.588 1393.427 2284.895  112.852  379.918
       50   293.338  363.787  494.530 1382.557 2287.593  113.675  385.218
       55   309.755  383.952  522.751 1386.861 2295.309  117.605  403.836
       60   339.454  420.432  573.921 1407.772 2309.413  125.285  438.034
       65   386.072  477.695  655.078 1448.107 2332.601  137.848  492.112
```

Title : Statewide totals Subarea Winter CYr 2009
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/02/26 12:23:35
Scen Year: 2009 -- All model years in the range 1965 to 2009 selected
Season : Winter
Area : Statewide totals Grand Total
I/M Stat : See county detail
Emissions: Tons Per Day

	Light Duty Passenger Cars				Light Duty Trucks				Medium Duty Trucks				Heavy Duty Trucks: Gasoline Trucks			Heavy Duty Trucks: Diesel Trucks	Heavy Duty Trucks: Total HD Trucks	Urban Buses	Motor-cycles	All Vehicles
	Non-cat	Cat	Diesel	Total	Non-cat	Cat	Diesel	Total	Non-cat	Cat	Diesel	Total	Non-cat	Cat	Total					
Vehicles	205436.	13032100.	45267.	13282800.	145209.	8098640.	168203.	8412050.	29829.	2784520.	186869.	3001210.	26299.	284035.	310334.	470939.	781274.	14487.	883451.	26375300.
VMT/1000	3259.	447499.	1040.	451798.	2886.	297458.	5315.	305659.	658.	110826.	8343.	119827.	259.	6297.	6556.	50830.	57386.	1742.	7642.	944054.
Trips	819673.	82194800.	250503.	83264900.	592263.	51031600.	1035230.	52659100.	270260.	28336100.	2283090.	30889500.	533808.	3136470.	3670270.	6937980.	10608300.	57946.	1766730.	179246000.
Total Organic Gas Emissions																				
Run Exh	24.41	46.36	0.22	70.99	21.90	41.90	0.51	64.32	5.95	22.69	2.04	30.68	2.20	6.82	9.01	59.30	68.31	2.27	32.30	268.88
Idle Exh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.60	0.02	0.63	0.03	0.18	0.21	6.69	6.90	0.00	0.00	7.53
Start Ex	5.58	54.24	0.00	59.82	4.06	39.68	0.00	43.75	2.26	24.44	0.00	26.71	8.08	7.29	15.36	0.00	15.36	0.08	5.45	151.16
Total Ex	29.99	100.60	0.22	130.80	25.97	81.58	0.51	108.07	8.22	47.74	2.06	58.02	10.30	14.29	24.59	65.99	90.58	2.35	37.75	427.58
Diurnal	1.31	10.72	0.00	12.04	0.88	6.52	0.00	7.39	0.06	1.72	0.00	1.79	0.02	0.07	0.08	0.00	0.08	0.00	1.80	23.10
Hot Soak	3.99	20.13	0.00	24.12	2.91	12.48	0.00	15.39	0.39	3.89	0.00	4.29	0.41	0.18	0.59	0.00	0.59	0.01	1.26	45.66
Running	18.40	54.75	0.00	73.15	8.28	62.83	0.00	71.11	1.24	25.43	0.00	26.67	2.82	2.49	5.31	0.00	5.31	0.05	5.58	181.88
Resting	0.66	5.03	0.00	5.69	0.43	3.08	0.00	3.51	0.04	0.86	0.00	0.90	0.01	0.02	0.02	0.00	0.02	0.00	0.68	10.80
Total	54.36	191.23	0.22	245.81	38.46	166.49	0.51	205.47	9.95	79.65	2.06	91.66	13.55	17.04	30.60	65.99	96.59	2.42	47.08	689.02
Carbon Monoxide Emissions																				
Run Exh	285.68	1119.39	0.89	1405.96	252.77	1087.16	3.37	1343.31	99.84	408.93	9.21	517.99	57.70	115.43	173.13	226.19	399.31	15.19	379.20	4060.96
Idle Exh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	3.42	0.18	3.63	0.17	1.05	1.22	28.32	29.55	0.00	0.00	33.18
Start Ex	28.07	589.66	0.00	617.73	20.55	485.31	0.00	505.86	14.28	281.33	0.00	295.61	56.66	119.09	175.75	0.00	175.75	1.04	19.85	1615.84
Total Ex	313.75	1709.05	0.89	2023.69	273.32	1572.47	3.37	1849.17	114.17	693.67	9.39	817.23	114.53	235.57	350.10	254.51	604.62	16.23	399.05	5709.98
Oxides of Nitrogen Emissions																				
Run Exh	17.86	127.75	1.76	147.37	15.60	158.87	8.99	183.46	5.03	77.93	50.20	133.16	1.68	29.08	30.76	866.90	897.66	32.24	11.88	1405.78
Idle Exh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.50	0.54	0.00	0.01	0.01	44.07	44.09	0.00	0.00	44.63
Start Ex	1.32	37.45	0.00	38.77	0.95	36.71	0.00	37.66	0.40	40.53	0.00	40.93	0.93	12.69	13.62	0.00	13.62	0.11	0.63	131.72
Total Ex	19.19	165.20	1.76	186.15	16.56	195.57	8.99	221.12	5.43	118.50	50.71	174.64	2.62	41.78	44.39	910.98	955.37	32.35	12.51	1582.13
Carbon Dioxide Emissions (000)																				
Run Exh	1.83	183.43	0.41	185.67	1.60	150.57	2.03	154.21	0.48	80.77	4.76	86.02	0.19	4.61	4.80	97.36	102.16	4.32	1.12	533.50
Idle Exh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.03	0.14	0.01	0.04	0.04	2.60	2.64	0.00	0.00	2.78
Start Ex	0.18	6.60	0.00	6.78	0.13	5.07	0.00	5.20	0.07	2.64	0.00	2.70	0.12	0.13	0.24	0.00	0.24	0.00	0.10	15.04
Total Ex	2.00	190.04	0.41	192.46	1.73	155.64	2.03	159.40	0.55	83.53	4.79	88.86	0.32	4.77	5.09	99.95	105.04	4.33	1.22	551.31
PM10 Emissions																				
Run Exh	0.12	5.49	0.14	5.75	0.10	7.01	0.30	7.41	0.02	2.66	0.47	3.16	0.01	0.06	0.07	33.03	33.10	0.50	0.33	50.24
Idle Exh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	1.02	1.02	0.00	0.00	1.02
Start Ex	0.01	0.56	0.00	0.57	0.01	0.66	0.00	0.67	0.00	0.25	0.00	0.25	0.01	0.01	0.02	0.00	0.02	0.00	0.03	1.55
Total Ex	0.13	6.05	0.14	6.33	0.11	7.67	0.30	8.07	0.03	2.91	0.48	3.41	0.01	0.07	0.09	34.05	34.13	0.50	0.36	52.81
TireWear	0.03	3.95	0.01	3.98	0.03	2.62	0.05	2.70	0.01	1.06	0.11	1.17	0.00	0.08	0.09	1.65	1.73	0.02	0.03	9.64
BrakeWr	0.05	6.19	0.01	6.25	0.04	4.11	0.07	4.23	0.01	1.53	0.12	1.66	0.00	0.10	0.11	1.34	1.45	0.02	0.05	13.65
Total	0.20	16.19	0.17	16.56	0.18	14.40	0.42	15.00	0.04	5.50	0.70	6.24	0.02	0.26	0.28	37.03	37.31	0.54	0.44	76.09
Lead	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.02	1.85	0.00	1.88	0.02	1.52	0.02	1.56	0.01	0.81	0.05	0.87	0.01	0.05	0.05	0.95	1.01	0.04	0.02	5.38
Fuel Consumption (000 gallons)																				
Gasoline	264.88	19760.43	0.00	20025.31	229.10	16211.26	0.00	16440.36	77.17	8676.95	0.00	8754.11	53.95	530.74	584.69	0.00	584.69	35.85	201.08	46041.41
Diesel	0.00	0.00	37.18	37.18	0.00	0.00	183.09	183.09	0.00	0.00	430.98	430.98	0.00	0.00	0.00	8995.72	8995.72	359.70	0.00	10006.67